

Handheld Chemical & Biological Agent Detector

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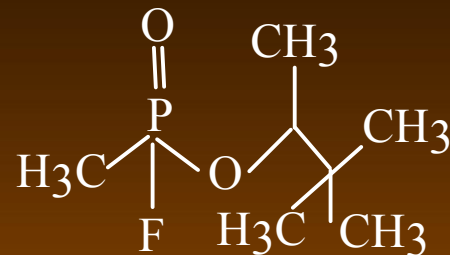
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Technology/Market Driver

Homeland Security and military operations are driving extensive public and private sector development efforts in chemical, biological, radiological, nuclear, and explosive sensor technology.

Symptoms of Nerve Agent Poisoning

Example: Soman



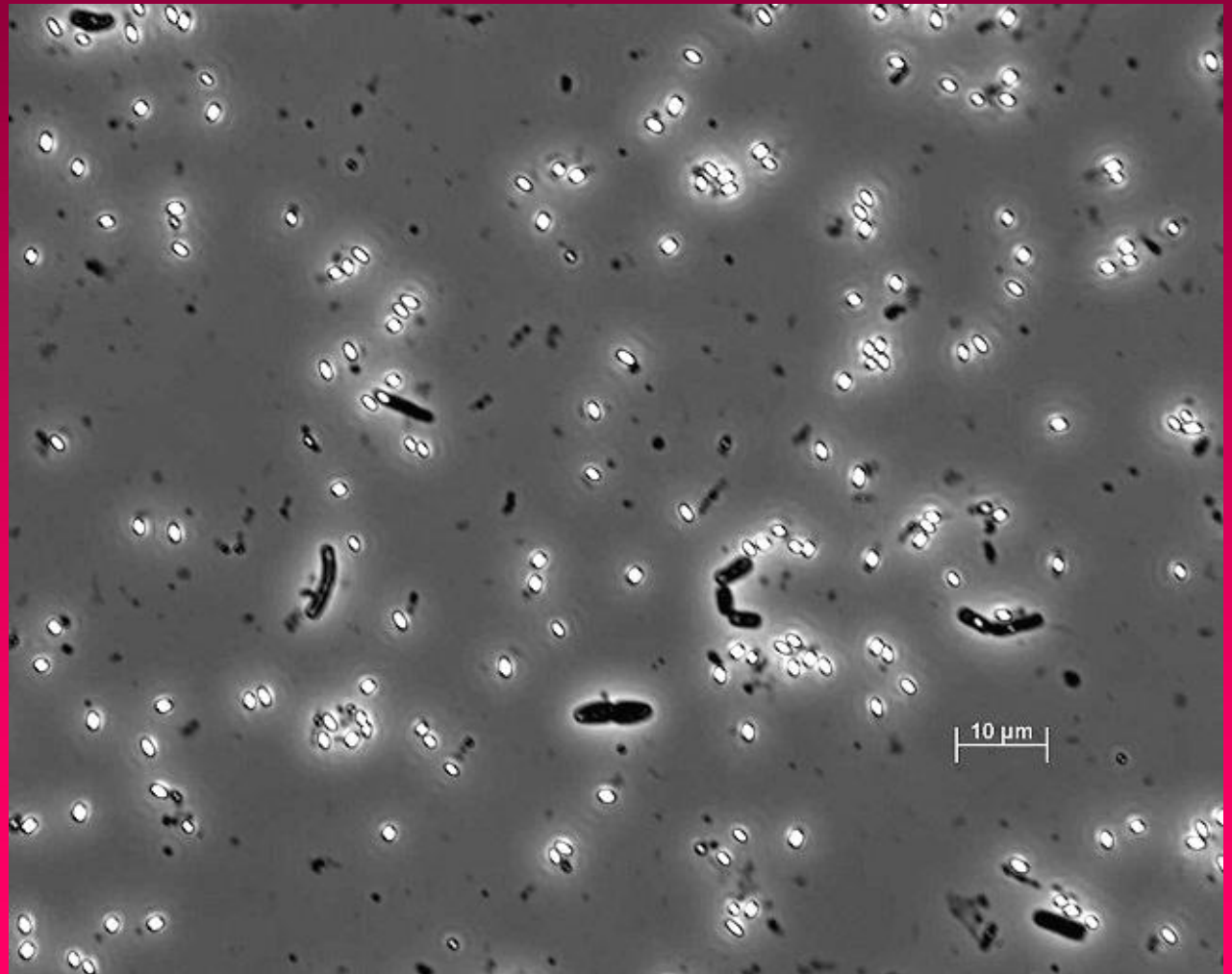
Neuromuscular Effects	Automatic Nervous System Effects	Central Nervous System Effects
<ul style="list-style-type: none">• Twitching• Weakness• Paralysis• Respiratory failure	<ul style="list-style-type: none">• Reduced vision• Small pupil size• Drooling• Sweating• Diarrhea• Nausea• Abdominal pain• Vomiting	<ul style="list-style-type: none">• Headache• Convulsions• Coma• Respiratory arrest• Confusion• Slurred speech• Depression• Respiratory depression

B. anthracis Spores

1,000X

Fever
Difficulty Breathing
Headache
Vomiting
Chills
Weakness
Abdominal pain
Chest pain
Shock

>90% mortality



Competition

- Chemical Detectors (e.g., Inficon & Smiths Detection)
 - Various technologies exist – most not sufficiently selective
 - Systems are not well-suited to security requirements – speed & portability
- Biological Detectors (e.g., Anzenbio & Idaho Technology)
 - Numerous DNA and antibody systems in development
 - Unable to detect a broad range of pathogens with a single sensor

Portable GC-MS System

Inficon



35 lbs

Ion Mobility Spectrometer

Smiths Detection



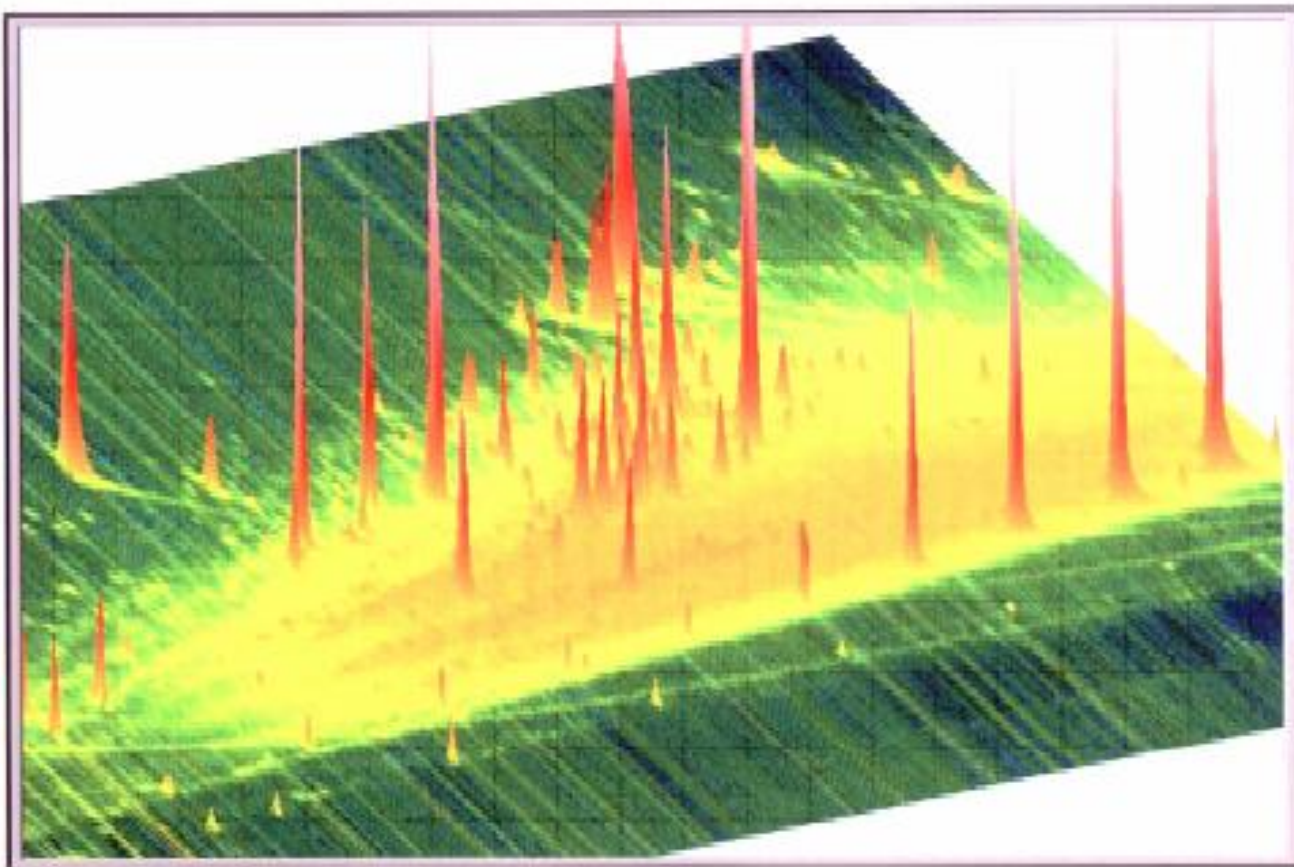
Description of New Technology

Miniature multidimensional combination

- Gas chromatography
- Ion mobility spectrometry
- Ion trap mass spectrometry

Multidimensional Separation

3-D Chemical Fingerprint

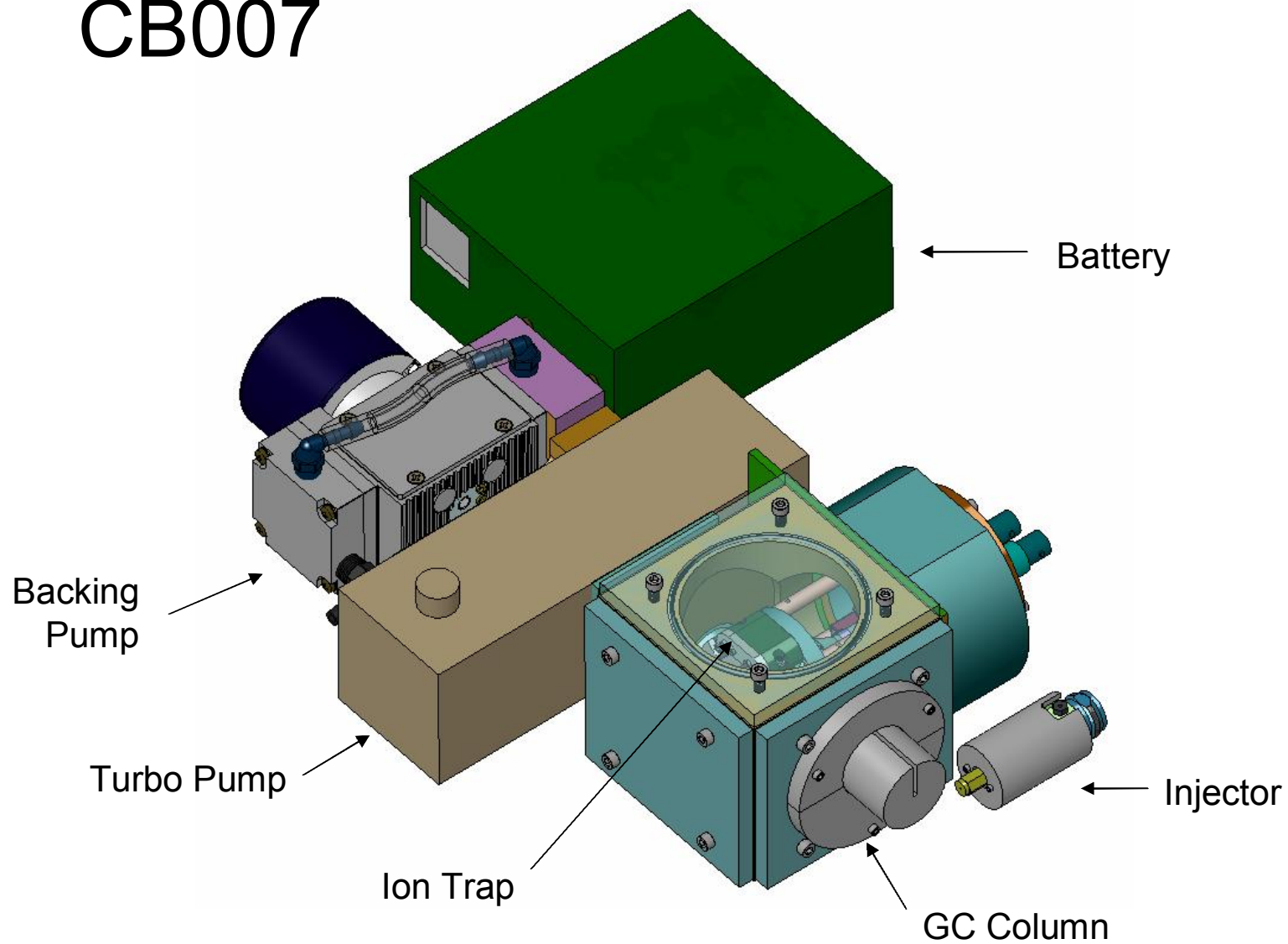


Z. Liu and M.L. Lee, *J. Microcol. Sep.* **12**, 241 (2000)

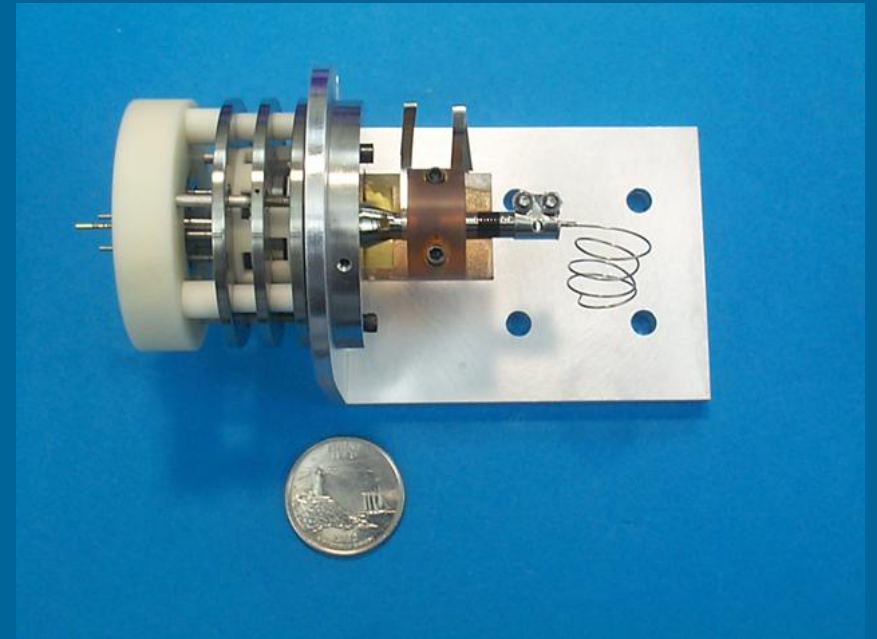
Detector Characteristics

- Applicable to both chemical and biological agents
- Self-contained, except sampling syringe and bacterial agent catalysis cartridge
- Weight: < 10 pounds
- Power:
 - Battery operated (12/24 VDC, BA 5590)
 - AC Power Adaptable
- Easy to operate (3-button control)
- Complete test in less than 5 min

CB007

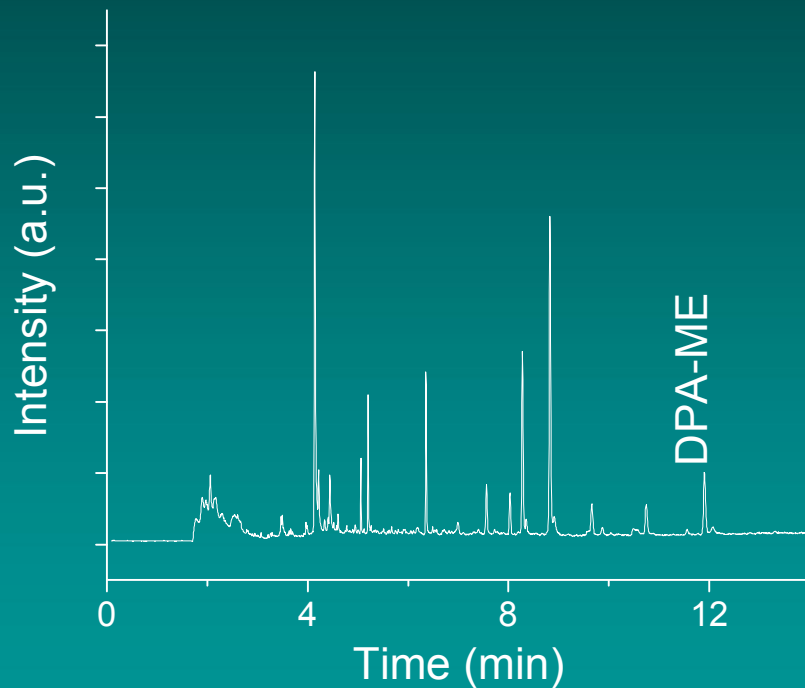


Ion Trap Assembly

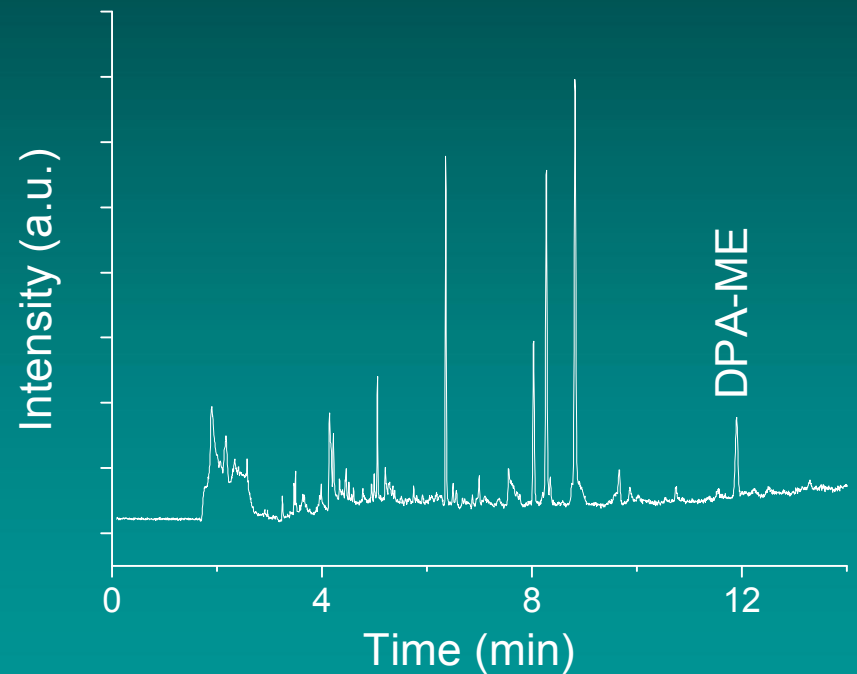


GC-MS Profiles from Bacterial Spore Catalytic Reaction

(Autoclaved Spores)



B. Anthracis



B. Anthracis (Sterne Strain)

Project Plan

- May 2003 Begin feasibility study
- Oct 2003 Begin module development
- Dec 2004 Begin module integration
- Dec 2005 Complete integrated prototype*

*Deliver 7 units to DTRA for testing/evaluation

CB007 Development Team

Membrane Sampling Syringe (MSS)

Jacolin Murry	Grad. Student
Jeff Jones	Mech. Engr.

Biological Agent Catalysis System (BACS)

Cal Bartholomew	PhD Chem. Engr.
Rich Robison	PhD Microbio./Molecular Bio.
Zhijun Jia	Post Doc, PhD Chem. Engr.
Phil Smith	Grad. Student
Aaron Nackos	Grad. Student
Jason Hawkes	Undergrad. Student
DJ Harvey	Undergrad. Student
Jeff Jones	Mech. Engr.

Gas Chromatograph (GC)

Jesse Contreras	Grad. Student
Lailiang Zhai	Grad. Student
Jeff Jones	Mech. Engr.

Ion Trap Mass Spectrometer (ITMS)

Steve Lammert	PhD Chemist
Samuel Tolley	Bioengr.
Alan Rockwood	PhD Chemist
Aaron Hawkins	PhD Elec. Engr.
Joshua Beutler	Undergrad. Student
Kevin Campbell	Undergrad. Student
Zachary George	Undergrad. Student
Jeff Jones	Mech. Engr.

Instrument Control & Data Processing

Dennis Tolley	PhD Statistician
James Oliphant	Physicist/Statistician
Ken Nemelka	Software Engr.
Hal Tolley	Software Engr.
Randy Waite	Elec. Engr.
Gary Collins	Elec. Engr.

Funding

- Committed next 6 months
 - Defense Threat Reduction Agency \$1,380,000
 - National Science Foundation 102,000
 - Dugway Proving Ground 31,250
- Projected 2006
 - Defense Threat Reduction Agency ?
 - Joint Program Office ?
 - National Science Foundation 102,000
 - Dugway Proving Ground 375,000

Estimated Current Market

- Military & homeland defense (>\$30 billion)
- Medical (>\$10.5 billion)
- Environmental (>\$2.6 billion)
- Food safety (>\$560 million)
- First responders (e.g., police, firemen) ?
- Workplace monitoring ?
- Pharmaceutical ?

Technology Transfer Experience

- 13 patents issued
- 5 patents pending
- 5 successful start-up companies
 - Alpine West Laboratories
 - MicroSeparations
 - Chromatography Conferences
 - Lee Scientific
 - Sensar Corporation

COEP Proposal

- Support completion of prototype detector and provide bridge funding
- Develop advanced sampling systems for air and water
- Further miniaturize detector
- Develop applications other than homeland security and military

Opportunity

- Proven novel technology
- Prototypes ready in 6 months
- Tremendous market potential
- Intellectual property in place
- Experienced development team
- Ready initial market